

What is claimed is:

1. A switching power source device comprising:
 - a rectifying device connectable to an AC power source;
 - a smoothing capacitor connected to an output of the rectifying device;
 - a transformer having at least first and second primary windings, and a secondary winding;
 - first and second switching elements connected to the output of the rectifying device by way of the first and second primary windings of the transformer respectively;
 - means for rectifying and smoothing a voltage generated to the secondary winding of the transformer;
 - means for outputting error amplified signal for setting a DC current output from the rectifying and smoothing means to a predetermined value; and
 - a control device that alternately turns ON and OFF the first and second switching elements based on the error amplified signal and an input voltage from the AC power source.
2. A switching power source device according to claim 1, further including a first series circuit formed of at least the first primary winding of the transformer, a diode, and the first switching element, and a second series circuit formed of at least the second primary winding of the transformer, another diode, and the second switching element, wherein the first and second series circuits are connected in parallel to form a parallel connection circuit, and the parallel connection circuit being connected to the output of the rectifying device.
3. A switching power source device according to claim 1, wherein the control device comprises:
 - an inverting and amplifying circuit that outputs a signal obtained by inverting and amplifying a multiplication value of the error amplified signal and a peak value of an output voltage of the rectifying circuit by 1/2 times as a first modulated wave; and
 - a first comparator circuit that compares a first carrier wave, which is generated separately, and the first modulated wave,

wherein the first switching element is controlled in response to an output of the first comparator circuit.

4. A switching power source device according to claim 1, wherein the control device further includes:

a multiplication circuit that outputs a signal obtained by multiplying the error amplified signal and an output voltage of the rectifying circuit as a second modulated wave; and

a second comparator circuit that compares a second carrier wave, which is generated separately, and the second modulated wave,

wherein the second switching element is controlled in response to an output of the second comparator circuit.

5. A switching power source device according to claim 3, wherein the control device further includes:

a multiplication circuit that outputs a signal obtained by multiplying the error amplified signal and an output voltage of the rectifying device as a second modulated wave; and

a second comparator circuit that compares a second carrier wave, which is generated separately and the second modulated wave,

wherein the second switching element is controlled in response to an output of the second comparator circuit.

6. A switching power source device according to claim 5, wherein phases of the first carrier wave and the second carrier wave are different from each other by 180°.

7. A switching power source device comprising:

a rectifying device connectable to an AC power source;

a transformer having first, second, and third primary windings, and a secondary winding;

a series circuit including the third primary winding of the transformer connected between positive-side and negative-side output terminals of the rectifying device, a first diode, and a smoothing capacitor;

another series circuit including a second diode connected to both ends of the smoothing capacitor, the first primary winding of the transformer, and a first switching element;

an additional series circuit including a third diode connected between the third primary winding and the first diode and the negative-side output terminal of the rectifying device, the second primary winding of the transformer, and a second switching element;

means for rectifying and smoothing a voltage generated by the secondary winding;

means for outputting an error amplified signal for setting a DC voltage output from the rectifying and smoothing means to a predetermined value; and

a control device that performs a PWM control of the first switching element in response to a first modulated wave generated based on an inverted and amplified waveform, which is a product of the error amplified signal and a full-wave rectified waveform of an input voltage from the AC power source, performs a PWM control of the second switching element in response to a second modulated wave generated based on the error amplified signal and the full-wave rectified waveform of the input voltage from the AC power source, and turns ON and OFF the first and second switching elements alternately.

8. A switching power source device according to claim 7, wherein the control device comprises:

an inverting and amplifying circuit that outputs a signal obtained by inverting and amplifying a multiplication value of the error amplified signal and a peak value of an output voltage of the rectifying device by $1/2$ times as a first modulated wave; and

a first comparator circuit that compares a first carrier wave, which is generated separately, and the first modulated wave,

wherein the first switching element is controlled in response to an output of the first comparator circuit.

9. A switching power source device according to claim 7, wherein the control device comprises:

a multiplication circuit that outputs a signal obtained by multiplying the error amplified signal and an output voltage of the rectifying device as a second modulated wave; and

a second comparator circuit that compares a second carrier wave, which is generated separately, and the second modulated wave,

wherein the second switching element is controlled in response to an output of the second comparator circuit.

10. A switching power source device according to claim 8, wherein the control device further includes:

a multiplication circuit that outputs a signal obtained by multiplying the error amplified signal and an output voltage of the rectifying device as a second modulated wave; and

a second comparator circuit that compares a second carrier wave, which is generated separately, and the second modulated wave,

wherein the second switching element is controlled in response to an output of the second comparator circuit.

11. A switching power source device according to claim 10, wherein phases of the first carrier wave and the second carrier wave are different from each other by 180°.

12. A switching power source device comprising:

a rectifying device connectable to an AC power source;

a transformer having first and second primary winding and a secondary winding;

a first series circuit formed of a first diode connected between positive-side and negative-side output terminals of the rectifying device;

a second series circuit formed of a second diode connected to both ends of a smoothing capacitor, the first primary winding of the transformer, and a first switching element;

a third series circuit including a third diode connected between the positive-side and the negative-side output terminals of the rectifying device, the second primary winding of the transformer, and a second switching element;

means for rectifying and smoothing means a voltage generated by the secondary winding;

means for outputting an error amplified signal for setting a DC voltage output from the rectifying and smoothing means to a predetermined value; and

a control device that performs a PWM control of the first switching element in response to a first modulated wave generated based on an inverted and amplified waveform, which is a product of the error amplified signal and a full-wave rectified waveform of an input voltage from the AC power source, performs a PWM control of the second switching element in response to a second modulated wave generated based on the error amplified signal and the full-wave rectified waveform of the input voltage from the AC power source, and turns ON and OFF the first and second switching elements alternately.

13. A switching power source device according to claim 12, wherein the control device comprises:

an inverting and amplifying circuit that outputs a signal obtained by inverting and amplifying a multiplication value of the error amplified signal and a peak value of an output voltage of the rectifying device by $1/2$ times as a first modulated wave; and

a first comparator circuit that compares a first carrier wave, which is generated separately, and the first modulated wave,

wherein the first switching element is controlled in response to an output of the first comparator circuit.

14. A switching power source device according to claim 12, wherein the control device comprises:

a multiplication circuit that outputs a signal obtained by multiplying the error amplified signal and an output voltage of the rectifying device as a second modulated wave; and

a second comparator circuit that compares a second carrier wave, which is generated separately, and the second modulated wave,

wherein the second switching element is controlled in response to an output of the second comparator circuit.

15. A switching power source device according to claim 13, wherein the control device further includes:

a multiplication circuit that outputs a signal obtained by multiplying the error amplified signal and an output voltage of the rectifying device as a second modulated wave; and

a second comparator circuit that compares a second carrier wave, which is generated separately, and the second modulated wave,

wherein the second switching element is controlled in response to an output of the second comparator circuit.

16. A switching power source device according to claim 15, wherein phases of the first carrier wave and the second carrier wave are different from each other by 180°.

17. A switching power source device comprising:

a rectifying device connectable to an AC power source;

a smoothing capacitor connected to the rectifying device;

a transformer having at least first and second primary windings;

first and second switching elements connected to the rectifying device;

and

a control device that alternately turns ON and OFF the first and second switching elements,

wherein at least the first primary winding, the rectifying device, and the first switching element form a first series circuit,

wherein at least the second primary winding, the rectifying device, and the second switching element form a second series circuit.

18. A switching power source device according to claim 17, wherein the first series circuit further includes first and second diode connected in series, and the second series circuit further includes a third diode, wherein the first and second series circuits are connected in parallel in relation to the rectifying device.

19. A switching power source device according to claim 18, further including a third series circuit formed of the first primary winding, the second diode, the smoothing capacitor, and the first switching element.
20. A switching power source device according to claim 19, further including a fourth series circuit formed of the smoothing capacitor, the first diode, and the rectifying device.
21. A switching power source device according to claim 18, wherein the transformer further includes a third primary winding, wherein the first and second series circuits each include the third primary winding.
22. A switching power source device according to claim 21, wherein the third primary winding, the first diode, the second diode, and the first primary winding are connected in series.
23. A switching power source device according to claim 21, further including a fourth series circuit formed of the smoothing capacitor, the first diode, the third primary winding, and the rectifying device.